REPORT

ON THE

CAWNPORE EXPERIMENTAL FARM,

FOR THE RABI SEASON, 1882-83.

ALLAHABAD:

NORTH-WESTERN PROVINCES AND OUDH GOVERNMENT PRESS.

1883.

No. $\frac{1007A.}{CXCIV.}$ OF 1883.

FROM

THE DIRECTOR, DEPT. OF AGRI. AND COMMERCE,
NORTH-WESTERN PROVINCES AND OUDH,

To

THE SECRETARY TO GOVERNMENT,
NORTH-WESTERN PROVINCES AND OUDH.

Dated Cawnpore, the 17th July, 1883.

SIR,

I HAVE the honor to submit Major Pitcher's report on the rabi harvest at the Cawnpore experimental farm.

2. The average outturn of wheat over the whole farm was this year 21·8 bushels per acre, which is 1·36 bushels less than the average outturn in the year before. The crop as a rule was not finer than that grown by neighboring cultivators, and may be accepted as representing with some fairness an ordinary outturn from cultivation of a normal character on land which is rather below than above the average.

3. The results from the experimental plots agreed very closely with those of last year. In both years saltpetre alone and saltpetre mixed with bone-dust gave by far the largest outturn. The difference obtained by adding bone-dust was very slight on both occasions, and on the last the plot without it did better than the plot with it. The produce in grain for both years is as follows:—

	Produce in grain.		Per cent. of increase on unmanured.	
	1882.	1883.	1882.	1883.
	lb.	lb.		
Saltpetre alone	1,424	2,080	84	102
Saltpetre with bone-dust	1,485	2,000	92	94
Wholly unmanured	774	1,032	...	...

It is doubtful, with these figures, whether bone-dust contributed at all to the superior productiveness. If it did it was certainly not in any proportion to the additional expense of Rs. 4-8-0 per acre which its application involves. It may further be remarked that saltpetre does not as yet show any sign of exhausting the soil, and a further confirmation is given to the view that, at least for the production of cereals, nitrogen is the one great want of soils like that of the farm.

4. Last year bone-dust gave a much larger return than bone superphosphate. This might probably be explained by some disturbing cause such as no single experiments can be sure of escaping. This year bone-dust and superphosphate were almost exactly equal. Similar results were obtained last year when both bone and mineral superphosphates were tried. There is nothing in the experiments as yet to show any great need of phosphoric acid; that lime should be wanted in the greater part of these provinces is nearly incredible. In neither year has gypsum made any appreciable effect on the yield, and it seems very doubtful whether there is any use in continuing this part of the experiment. It may be of some advantage in the case of leguminous crops, but it seems to be of little direct use to cereals.

5. Another form of applying nitrates is by ploughing in some leguminous crop, an operation which has probably a further advantage in the mechanical opening up of the soil. The result this year was that the outturn of grain of six plots so treated averaged 1,653 lb, while that on six plots similarly situated but unmanured was 1,271 lb. The additional 382 lb per

acre were obtained at a cost of at the outside Rs. 2-8-0, and, being worth nearly Rs. 10, gave a very handsome profit on the outlay.

6. The advantages of deep ploughing were very strikingly shown. By inverting the soil to a depth of nine inches the produce was nearly doubled, a depth of five inches increased it by 32 per cent., and in both cases only two ploughings were given to four by the ordinary native plough. In fact, the superiority of moderately deep ploughing on all ordinary soils has long been placed beyond question.

7. The experiments with well and canal water were continued ; the results, omitting straw, in the two years being as follows :—

	Canal. lb.	Well. lb.	Per cent. increase of well over canal.
1882	1,110	1,449	30
1883	1,227	1,380	12

The experiments have not been carried on long enough to enable us to conclude with certainty that well water is in itself a better fertilizer than canal water. The advantage it has in the greater opportuneness with which it can be applied was alluded to in last year's report; on the other side must be put its greater expense.

8. The English barleys gave rather a better yield this year than they did last, producing on an average 1,077 lb per acre against the former average crop of 848 lb. They are still far inferior in productiveness to the ordinary native variety, which again continues to yield about twice as heavy a crop as the Kotgarh barley. Cape oats show no sign of deterioration, and this year have yielded as much as 2,026 lb to the acre. English wheat does not promise to succeed. It is far too slow in arriving at maturity.

9. An attempt to supply unprepared linseed fibre for the purpose of paper manufacture disappointed any expectations that may have been formed of it. A white variety of linseed, not generally known in these provinces, was imported from Jalaun and yielded an oil of exceptional purity and brilliancy, which might become a valuable article of commerce.

10. The ensilage which had been partly damaged by the rain in January was closed up again and not re-opened till May. The fodder was considerably fermented, but not so injured as to make it unfit for cattle food ; and the possibility of keeping green fodder from the end of one rainy season to the beginning of the next was clearly demonstrated. The subject is a new one, not only here but in England and America, and there are many questions of detail which are waiting for solution. Major Pitcher's suggestion to scatter boosa between the layers of green stalk, and to use it instead of earth as a top covering, is one that appears to deserve trial.

11. Among the new implements experimented with, there are two which promise to be of use to Indian agriculture. A cheap and efficient hand-threshing machine, which only cost Rs. 128-9-0 when imported, and might probably be made up for less in this country, was found to be much more expeditious and more cleanly in its action than the ordinary method of treading out by oxen. A new form of sugar evaporator, imported from America, promises to be a still more valuable addition to the existing stock of implements. It is cheaper than the apparatus of iron pans which is now in use, it is incomparably more rapid and simple in its operation, and it produces a finer quality of ráb. At the various agricultural shows where it was exhibited it attracted much attention, and copies are being made for the sugar manufactory at Rosa, and for Pandit Ajodhya Prasád of Indalpur, whose agricultural experiments have lately been in the main concentrated on the production of sugar.

I have the honor to be,

SIR,

Your most obedient servant,

W. C. BENETT,

Dir., Dept. of Agri. and Commerce, N.-W. P. and Oudh.

GOVERNMENT
N.W.P.

REPORT

ON THE

CAWNPORE EXPERIMENTAL FARM

FOR THE RABI SEASON OF 1882-83.

1. *Character of the season.*—The season was again abnormal in character. In September and October last only two inches of rain fell instead of 6·49 inches the normal quantity, and, as a consequence, the moisture in the soil so necessary for the rabi sowings was barely sufficient for proper germination. Between the 1st October and the 25th January only ·5 inches of rain fell, and matters began to look very threatening for all those cultivators who had no canal water at their service. On the farm lands, two waterings had been given to most of the crops, and to some had been given three waterings, when, on January 25th and following days, three inches of rain fell accompanied by very high wind. The most forward and most promising crops being then in flower, they necessarily suffered from the effects of the storm to a greater degree than crops less advanced, and but for this accident the yield in some of the manured experimental plots would have been higher than what is shown against them. A general result on the yield was a greater proportion of straw to grain than usual.

One advantage of experimental stations is the test they afford of the true character of the season's outturn. Last year the maximum outturn of wheat per acre on the farm amounted to 2,820 lb (47 bushels). This year it in no case exceeded 2,181 lb (36·3 bushels); while on 16·8 acres the average was 1,390 lb (23·16 bushels) last year against 1,309 lb (21·8 bushels) this year. This gauge of the season's yield is, I find, in accord with the estimate current amongst the zamindars.

Again, when I was out in camp, complaints were rife of the great damage done to mustard crops by blight. Returning to the farm I found that our loss from the same cause amounted to some 50 per cent.

In March a hailstorm of some severity passed over the city of Cawnpore leaving the farm comparatively untouched. Had the farm lain in its track, I should say, judging from the size of the hailstones, that the result would have necessitated the remission of a considerable portion of this report. Owing to the damage caused to vineyards in France by hailstorms, considerable attention has been given to their occurrence by scientific men, and amongst others M. Arago held that by intercepting the electricity of the passing cloud and conducting it to the earth, the hail would fall innocuous as rain. Factory chimneys, as he showed in the case of Manchester, have an effect in this way in increasing the rainfall. It will be interesting to observe, as time goes on, whether the increasing number of factory shafts in Cawnpore seem to attract rain to it. Already as I write the increased quantity that has fallen in the city, as compared with what has fallen on the farm three miles away, has been very marked.

It was noticed that after the hailstorm the grain of some of the barley lost its brightness, and eventually when threshed out it was classed in the bazaar as old grain, and priced lower in consequence.

2. *Operations of the season.*—The following experiments were planned :—

(1) Experiments with manure.
(2) Ditto in ploughing.
(3) Ditto in irrigation.
(4) Ditto in thin sowing.
(5) Ditto with varieties of seed.

The experiments with manures comprised—

(*a*) The standard series of wheat plots manured with nitrogenous and non-nitrogenous manures in duplicate.

(*b*) That known as the "Ville" series.

(*c*) Various.

The treatment of the plots of the standard series for the past four years and for the present year has been as under:—

Previous treatment.			*Treatment during the season.*			
Year.	Season.	Manure.	Crop.	Ploughing.	Seed per acre.	Irrigation.	Weeding.
1878 ...	Kharif ...	Nil.	Nil ...				
1879 ...	Rabi ...	Do.	Barley ...				
1879 ...	Kharif ...	Do.	Cotton ...				
1880 ...	Rabi ...	Do.	Nil ...				
1880 ...	Kharif ...	Do.	Maize ...				
1881 ...	Rabi ...	Do.	Nil ...				
1881 ...	Kharif ...	As now applied.	Maize ...				
1882 ...	Rabi ...	Do.	Wheat ...				
1882 ...	Kharif ...	Nil.	Nil ...				
1883 ...	Rabi ...	As now applied.	Wheat ...	Three ...	120 lb ...	Twice ...	Once.

The following table shows the results obtained with the various manures:—

Manure.	Amount in lb. per acre.	Outturn per acre.			
		Grain.		*Straw.*	
		Standard.	Duplicate.	Standard.	Duplicate.
		lb. oz.	lb. oz.	lb.	lb.
Potassic nitrate ...	240	1,978 8	2,181 0	3,636	3,906
Potassic nitrate ... and Bone-dust ...	240 / 360	1,944 12	2,055 12	3,690	3,834
Farmyard manure ...	14,400	1,713 0	1,623 0	3,126	2,958
Farmyard manure ... and Calcic sulphate ...	14,400 / 240	1,761 0	1,886 4	3,270	2,778
Farmyard manure ... and Bone-dust ...	14,400 / 360	1,584 0	1,400 10	2,634	2,412
Farmyard manure (reduced to ashes) ...	14,400	1,383 0	1,417 8	2,412	2,436
Bone superphosphate ...	240	1,347 12	1,271 4	2,040	2,100
Bone-dust ...	360	1,032 12	1,433 4	1,704	2,424
Calcic sulphate ...	240	996 0	1,152 0	1,554	1,824
No manure ...	...	1,065 0	999 0	1,764	1,704

The high proportion of straw to grain, as compared with last year's results and to which allusion has already been made, may be traced in the first six plots.

It will be interesting to note as time goes on how far potassic nitrate alone unaided by cinereal (or mineral) manures will suffice to maintain fertility. The use of nitrous earth as a manure is freely resorted to by native cultivators in the shape of a top dressing to poppy tobacco, wheat, jetia sawan, and sometimes I believe to maize.

Mr. Warrington writes*: "As the whole object of artificial manuring is to supplement the deficiencies of the soil, it is highly desirable that a farmer should ascertain by trials in the field what is the actual amount of increase which he obtains from the manure he purchases. A few carefully made experiments will teach him what his land and crops are really in need of. Should he add superphosphate with the nitrate of sodium for his wheat? What dressing of the nitrate is most economical? Is superphosphate alone sufficient for his turnip crop, or should guano or nitrate be employed as well? What is the smallest quantity of superphosphate sufficient for the crop? Will it pay to use potassium salts for his seeds or pasture? These and many other questions can only be answered by trials on his own fields, and on the farmer's knowledge of such facts will depend the economy with which he is able to use purchased manures."

* Chemistry of the Farm.

This extract explains in clear language what we are attempting to do at the farm, *viz.*, to arrive by degrees at some sort of estimate as to how far the wheat crops of these provinces may be benefited by the application of manures which will pay for their purchase, at the same time maintaining fertility and not simply exhausting it. Variations will be made as experience suggests. For instance, we are now able to see pretty clearly how useless the application of calcic sulphate by itself is for a cereal crop, though the addition of it to farmyard manure appears to produce some increase in the effect of the latter, owing no doubt to its converting part of the insoluble nitrogenous humus into soluble ammonia compounds. But the plot is in no wise thrown away. Calcic sulphate has a marked and important effect in the growth of leguminous plants, and its proper place towards cereal crops is in aiding in the growth of a leguminous crop such crop to be ploughed in for wheat. Under this treatment the plot in question may take a higher place next year. So also with the superphosphate plot, it will for next year be used for a nitrous superphosphate manure experiment.

The following table shows the cost and profit of applying each manure during the season under report. I may note that the calcic sulphate (or gypsum) was obtained very cheaply at four annas a maund, as the waste product of soda-water manufacture. Considering the unquestionable evidence from England and America as to its good effect on leguminous crops, it is worth more notice than it seems to have received hitherto from indigo growers. Large natural beds of gypsum exist in the hills both of the North-Western Provinces and of the Punjab.

Manure.	Cost per acre.	*Value of produce per acre.*		Average value of produce.	Profit on manured over unmanured plot.	
		Standard.	Duplicate.			
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
Potassic nitrate	7 8 0	69 1 0	75 11 6	72 6 3	29 8 6	
Ditto and bone-dust	12 0 0	68 5 9	71 15 10	70 2 9	22 13 0	
Farmyard manure	9 0 0	59 11 3	56 8 10	58 2 0	13 12 3	
Ditto and calc. sulphate ...	10 0 0	61 9 9	63 0 9	62 5 3	16 15 6	
Ditto and bone-dust ...	13 8 0	54 2 7	48 3 8	51 3 1	2 5 4	
Ditto ashes only	9 0 0	47 11 7	48 12 8	48 4 1	3 14 2	
Bone superphosphate	14 8 0	45 4 4	43 6 8	44 5 6	5 8 3	Loss.
Bone-dust	4 8 0	35 4 1	49 2 10	42 3 5	2 5 8	
Calc. sulphate	1 0 0	33 10 3	39 0 4	36 5 3	0 0 6	Loss.
Unmanured	...	36 6 2	34 5 4	35 5 9	...	

B.—The Ville plots.

(*b*) *The Ville plots.*—These were a repetition on the same plots of last year's work illustrating by growing crops on the land how a practical analysis of the soil may be made. It must be admitted though that experiments of this sort run too great risk from the chances of weather to be very largely adopted in practice and that they are more interesting than practical.

The treatment of these plots during the past four years and during the present year has been as follows :—

Year.	*Previous treatment.*			*Treatment during* 1882-83.			
	Season.	Manure.	Crop.	Ploughing.	Seed per acre.	Irrigation.	Weeding.
1878 to 1879 ...	Kharif ...	*Nil.*	*Nil.*				
	Rabi ...	„	Barley ...				
1879 to 1880 ...	Kharif ...	*Nil.*	Cotton ...				
	Rabi ...	„	*Nil.*				
1880 to 1881 ...	Kharif ...	*Nil.*	Sorgho ...				
	Rabi ...	„	*Nil.*				
1881 to 1882 ...	Kharif ...	Same as now applied.	Maize ...				
	Rabi ...		Wheat ...				
1882 to 1883 ...	Kharif ...	...	*Nil.*				
	Rabi ...	As in table...	Wheat ...	Three ...	120 lb. ...	Twice ...	Once.

The following table gives this year's results, in considering which the qualifying effect of the January storm must be borne in mind. The effect, however, of withdrawing the nitrogen in the case of a cereal crop is still plainly enough marked :—

Number of plot.	Manures and rate per acre.	*Outturn per acre.* Grain.		Straw.	*Difference between the outturn of each plot and that of plot No. I.* Grain.		Straw.	Remarks.
		lb.	oz.	lb.	lb.	oz.	lb.	
I. ...	Calcic superphos, 180 lb. ... Ammo. cloride, 138 „ ... Potass sulphate 90 „ ... Calc. sulphate 96 „ ...	1,726	8	2,772	...		...	The most advanced when the rain fell and therefore most injured.
II. ...	Do. less calc. superphosphate	1,771	8	3,252	45	0	480	Gain.
III. ...	Do. „ ammo. cloride ...	1,192	8	1,824	534	0	948	Loss.
IV. ...	Do. „ potass. sulphate ...	2076	0	3,936	349	8	1,164	Gain.
V. ...	Do. „ calcic. sulphate ..	1,641	0	2,388	85	8	384	Loss.
VI. ...	No manure	1,045	8	1,428	681	0	1,344	Loss.

C.—Various Manures.

Under this heading come chiefly experiments in green-soiling. Fairly large fields were taken up and divided into manured and unmanured portions, and changes were rung on hemp and on indigo refuse. Two plots will be found of cinereal manures very common and very commonly neglected, *viz.* brick kiln refuse and ashes of weeds. The following table shows the treatment of the fields during past seasons as well as in the present season :—

Number of field.	*Previous treatment.* Year.	Manure.	Crop.	*Treatment during* 1882-83. Manure.	Ploughing with earth-turning plough.	Seed and rate per acre.	Irrigation.	Weeding.
1	1878-79	Nil ...	Wheat ...	A portion with hemp, another left unmanured.	Four ...	Wheat 120lb.	Twice ...	One.
	1879-80	Dung ...	Ditto ...					
	1880-81	Dung ...	Wheat and flax					
	1881-82	Nil ...	Cotton ...					
2	1878-79	Nil ...	Maize ...	A portion with hemp, another with hemp and gypsum, and the remaining portion left unmanured.	Four ...	Ditto ...	Ditto ...	Ditto.
	1879-80	Guano ...	Wheat ...					
	1880-81	Dung ...	Ditto ...					
	1881-82	Nil ...	Cotton ...					
3	1878-79	Same as No. 2...	Same as No. 2...	A portion with hemp, and another left unmanured.	Four ...	Ditto ..	Ditto ...	Ditto.
	1879-80							
	1880-81							
	1881 82							
4	1878-79	Nil ...	Barley ...	Ditto ...	Four ...	Ditto ...	Ditto ...	Ditto.
	1879-80	Nil ...	Linseed ...					
	1880-81	Nil ...	Wheat ...					
	1881-82	Nil ...	Wheat ...					
5	1878-79	Nil ...	Juar ...	Ditto ...	Three ...	Ditto ...	Ditto ...	Ditto.
	1879-80	Nil ...	Nil ...					
	1880-81	Dung ...	Wheat ...					
	1881-82	Nil ...	Mung and Til...					
6	1878-79	Nil ...	Juar ...	A portion with fresh indigo refuse and lime, another with last year's refuse and lime, a third with last year's refuse only, and the fourth unmanured.	Three ...	Ditto ...	Ditto ...	Ditto.
	1879-80	Nil ...	Nil ...					
	1880-81	Dung and gypsum	Wheat ...					
	1881-82	Nil ...	Wheat and gram					
A.	1878-79	Nil ...	Barley ...	Hemp and gypsum,	Three ...	Ditto ...	Ditto ...	Ditto.
	1879-80	Nil ...	Cotton ...					
	1880-81	Nil ...	Juar ...					
	1881-82	Hemp and gypsum	Wheat ...					
B.	1878-79	Nil ...	Barley ...	Hemp ...	Three ...	Ditto ...	Ditto ...	Ditto.
	1879 80	Nil ...	Cotton ...					
	1880-81	Indigo ploughed in	Wheat ...					
	1881-82	Hemp ...	Ditto ...					
C.	1878-79	Nil ...	Barley ...	Unmanured ...	Three ...	Ditto ...	Ditto ...	Ditto.
	1879-80	Nil ...	Cotton ...					
	1880-81	Nil ...	Juar ...					
	1881-82	Nil ...	Wheat ...					
D.	...	Not known ...	...	Brick-kiln refuse ...	Three ...	Ditto ...	Ditto ...	Ditto.
E.	...	Ditto ...	...	Ashes of weeds ...	Three ...	Ditto ...	Ditto ...	Ditto.

The following table shows the result obtained :—

Number of fields.	Particulars of manure applied during the year.	Area in square yards.	*Actual outturn.*		*Outturn per acre.*	
			Grain.	Straw.	Grain.	Straw.
			lb oz.	lb. oz.	lb.	lb.
1	Hemp ploughed in	4,400	1,743 9	3,993 12	1,917·9	4,393·1
1	No manure	4,010	1,515 5	2,630 4	1,828 9	3,174·6
2	Hemp and gypsum	851	325 9	466 12	1,851·6	2,654·6
2	Hemp	1,759	640 14	1,064 12	1,763·4	2,929·7
2	No manure	2,387	630 1	1,116 15	1,277·4	2,264·7
3	Hemp	2,415	838 15	1,402 4	1,679·2	2,810·3
3	No manure	2,496	520 6	823 8	1,009·0	1,596·8
4	Hemp	3,654	915 1	1,957 0	1,212 0	2,592·1
4	No manure	3,375	565 6	1,204 0	810 7	1,726 6
5	Hemp	2,581	943 4	1,854 12	1,768·8	3,478·1
5	No manure	2,078	514 7	788 0	1,198·2	1,835·3
A.	Hemp and gypsum	400	153 10	310 5	1,858 8	3,754 8
B.	Hemp	400	113 8	183 7	1,373·3	2,219·6
C.	No manure	400	88 0	145 13	1,064 8	1,764·3
D.	Brick-kiln refuse	400	124 15	217 11	1,511·7	2,634·0
E.	Ashes of weeds	400	112 11	200 14	1,363·5	2,430 6
6	Fresh indigo refuse and lime	1,661	554 4	1,019 0	1,615 0	2,969·2
6	Last year's indigo refuse and lime ...	797	194 10	285 0	1,181 9	1,730·7
6	Last year's indigo refuse	785	182 11	301 5	1,126 3	1,857 7
6	No manure	1,532	240 5	308 8	759·2	974·6

Green-soiling with hemp* appears to be so cheap and so effective that there must be some good reason for its not being more systematically adopted. It is very commonly practised in some parts of Oudh, particularly near the city of Lucknow, but the cultivators tell me that they only practise it occasionally when the land is out of heart and when they cannot afford to purchase poudrette. It is only used by them for cereal crops and the objection against perennial use of it is not quite clear. Possibly the land after a time lapses into a condition analogous to that of clover sickness, and it is worth while putting this to the proof.

The cost is very trifling and is no more than the cost of seed, of sowing it broadcast and of pulling the plants and laying them in furrow, the ploughing would come in any case. The Oudh cultivator is still more economical in levelling the plants with a heavy log dragged across the fields by bullocks and then ploughing in the levelled plants. Per acre the cost is —

	Rs. a. p.
Seed 30 seers at Re. 1-4-0 per maund	0 15 0
Sowing	0 1 0
Cutting and laying in furrow	1 8 0
Total ...	2 8 0

In the case of indigo refuse the cost is necessarily regulated by the distance of the vats from the fields, and the material is bulky.

Natives have, I believe, a prejudice against using the refuse during the season immediately following indigo manufacture, on the score of its being too heating, and only use it in the following year. Their idea of heating is quite correct, for left in heaps a strong fermentation is developed with great heat leading to great loss of ammonia, and the refuse (or *sit*) left contains nitrogen in a very insoluble form. In the indigo districts of Bengal I understand the prejudice against fresh *sit* has long disappeared from the European factories, and when carted out fresh and buried into furrows *sit* is considered a good dressing for three years or so. The addition of caustic lime with a view to assisting decomposition forming soluble ammonia compounds, correcting the acidity of the organic acids and in freeing ammonia to be oxidised in the soil and to form nitrates for the use of a cereal crop, seems advisable, and is supported by the figures in the table given. There should of course have been a plot manured with fresh refuse without lime for a fair comparison, but unfortunately it was overlooked. That lime should have had little effect on old refuse was no more than was expected.

* The "hemp" referred to is *sanai* (crotalaria juncea).

The following table shows pecuniary results :—

Number of fields.	Manure and rate per acre.	Cost of manure per acre.	Value of produce per acre.			Net increase over the unmanured.
			Grain.	Straw.	Total.	
		Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a p.	Rs. a p.
1	Hemp	2 8 0	52 10 0	17 13 8	70 7 8	4 14 5
1	No manure	...	50 2 11	12 14 4	63 1 3	...
2	Hemp and gypsum 160 lb	3 2 0	59 12 8	10 12 7	61 9 3	14 3 3
2	Hemp	2 8 0	48 6 1	11 14 6	60 4 7	13 8 7
2	No manure	...	35 0 9	9 3 3	44 4 0	...
3	Hemp	2 8 0	46 1 2	11 6 9	57 7 11	20 13 3
3	No manure	...	27 10 11	6 7 9	34 2 8	...
4	Hemp	2 8 0	33 4 1	10 8 10	43 12 11	12 0 3
4	No manure	...	22 4 5	7 0 3	29 4 8	...
5	Hemp	2 8 0	48 8 4	14 2 2	62 10 6	19 13 4
5	No manure	...	32 13 10	7 7 4	40 5 2	...
A	Hemp and gypsum 240 lb	3 8 0	51 0 3	11 3 3	62 3 6	22 5 4
B	Hemp	2 8 0	37 10 9	9 0 4	46 11 1	7 12 11
C	No manure	...	29 3 6	7 2 8	36 6 2	...
6	Fresh indigo refuse* 120 maunds and lime 6 maunds.	6 0 0	44 5 4	12 1 1	56 6 5	25 9 10
6	Last year's refuse and lime 6 maunds ...	7 3 3	32 6 1	7 0 6	39 6 7	7 6 9
6	Last year's refuse	6 0 0	30 14 4	7 8 9	38 7 1	7 10 6
6	No manure	...	20 13 3	3 15 4	24 12 7	...

3. *Deep and shallow ploughing.*—A new field was selected this season and was divided into four sections by wide paths. The sections were treated as follows :—

First—Ploughed to a depth of nine inches, once in the rains and once at time of sowing.

Second—Ploughed to a depth of five inches, once in the rains and once at the time of sowing.

Third and fourth—Ploughed with the ordinary native plough, twice in the rains and twice at the time of sowing.

Last year plots I. and II. were ploughed to the depth of five inches, but plots III. and IV. were ploughed in the usual manner with the native plough.

Wheat was sown broadcast in all the plots.

The results are shown in the following table :—

No. of plot.	Area in square yards.	Actual outturn.		Outturn per acre.	
		Grain.	Straw.	Grain.	Straw.
I. ...	373	79 14	131	1,036·4	1,699
II. ...	293	46 15	73	775·3	1,206
III. ...	373	45 6	71	588·7	921
IV. ...	355	42 14	69	584·5	940

The plots were admittedly smaller than is desirable, but it is difficult to find space on the farm which has not been cultivated with an improved plough. In explanation of the generally low yield, it may be explained that the field had been heavily cropped for the past two years, and that no manure was used. Deep ploughing it may be remarked has never been advocated at the farm as beneficial regardless of the nature of the sub-soil, but only when a depth of good soil warrants its application.

4. *Irrigation.*—Six plots each $\frac{1}{12}$th of an acre are set out along the canal bank and arranged with a view to the value of more waterings than one being tested. The storm in January interfered too much to render the results of great value; the outturn was in all cases necessarily very low as no manure was used, and the ground had been purposely exhausted for three years previously by double cropping without manure. The diminished outturn is indeed instructive as to what can be done in the way of robbing land of its fertility.

	Rs. a. p.
* Cost per 100 maunds of fresh refuse	4 0 0
Ditto old ditto	5 0 0

No. of Field.	No. of waterings.	Outturn per acre.		Increase per acre on each watering over the unwatered plot.	
		Grain.	Straw.	Grain.	Straw.
		lb. oz	lb.	lb. oz.	lb.
I. ...	Nil ...	330 0	585	...	...
II. ...	One ...	412 8	666	82 8	81
III. ...	Two ...	481 8	801	151 8	216
IV. ...	Three ...	651 8	1,050	321 8	465
V. and VI. ...	Four ...	698 4	1,312	368 4	727

The result, so far as it goes, is to show a much greater proportionate increase in the third watering than in the rest, but still an increase on each. Whether the increase on waterings over three covers the cost, will always depend on the extent to which the crop has been manured. Whether manured or not, the cost of irrigation would be the same, and with fields so depleted of fertility as these, all that can be done is to demonstrate the ratio of increase. Cost cannot be fairly brought into comparison.

Another series tried was well *versus* canal irrigation.

Three plots of $\frac{1}{12}$ of an acre each and lying in a row were taken. The two outer plots are each close to tanks of equal capacity, one of which can be filled from the canal and the other from a well. The centre plot was unirrigated and the outer plots were irrigated with measured quantities from their respective reservoirs.

The yield from the unirrigated plot was practically nil. The results from the other plots may be gathered from the following table :—

System of irrigation.	Outturn per acre		Value of produce per acre.		
	Grain.	Straw.	Grain.	Straw.	Total.
	lb. oz.	lb.	Rs. a. p.	Rs a p	Rs. a. p.
By well	1,380 12	2,118	37 14 2	8 9 9	46 7 11
By canal	1,227 0	2,298	33 10 8	9 5 5	43 0 1

Here the well irrigation shows to small advantage over the canal as regards fertility, but when the question of cost is imported into the comparison, canal irrigation has the best of it. On the farm the calculation is—

For lift-irrigation from the canal (one lift) including labour, three waterings, canal dues, cost of baskets, &c., per acre=5-9-0.

For well-irrigation from a depth of 30 feet and giving three waterings, per acre=9-3-0.

And to this latter calculation must be added some unknown quantity, as interest on capital sunk in well and on bullocks, a charge which is included in canal dues.

5. *Thin sowing.*—A field of fair size was divided into four parts—

(1) was sown in the ordinary way in every furrow,

(2) was sown in every second furrow,

(3) was sown in every third furrow,

(4) the seed was dibbled in by hand a foot apart each way.

The treatment of the field during the past four years and during the present year was as under—

Previous treatment.			Treatment during the season under report.					
Year.	Manure.	Crop.	No. of plot.	Manure.	Amount of seed per acre.	Ploughing.	Irrigation.	Weeding.
					lb			
1878-79 ...	*Nil.*	Sorghum ..	1	Green soiled with hemp.	103	Three ...	Two ...	One.
1879-80 ...	Guano.	Wheat ...	2	Ditto ...	41	Ditto ...	Ditto	Ditto.
1880-81 ...	*Nil*	Ditto ...	3	Ditto ...	21	Ditto ...	Ditto ...	Ditto.
1881-82 ...	*Nil.*	Flax ...	4	Ditto ...	18	Ditto ...	Ditto ...	Ditto.

The following table shows the area and outturn of each plot—

Number of plot.	Area in square yards.	*Actual outturn.*		*Outturn per acre*		*Decrease.*	
		Grain.	Straw.	Grain	Straw.	Grain.	Straw.
		lb oz.	lb.	lb.	lb.	lb.	lb.
1 Every furrow	1,144	377 2	713 0	1,595 5	3,016·5	...	...
2 Every 2nd do	1,122	293 15	581 0	1,267 9	2,506 2	327·6	510·3
3 Every 3rd do.	1,156	323 12	612 0	1,355 4	2,562 3	240 1	454·2
4 Dibbled in by hand	1,173	214 5	366·0	884·2	1,510 1	711·3	1,506·4

These experiments, conductedon a larger scale than the similar series of last year, give rather different results. From close personal observation of the plots the only conclusion I can draw is, that for improving seed selected grain should be sown, dibbled in on well-manured plots of known even fertility throughout, and the crop reserved for sowing in the ordinary way in the following year, and that sowing in the ordinary way has an advantage in the suppression of weeds, which is very important, seeing that the introduction of the seeds of these weeds, some of which are no doubt bitter, might very materially damage the character of a consignment for milling purposes. I noticed in our thinly-sown crops this year an abundant growth of a diminutive bind-weed which only appeared when the stalks were high and strong enough to afford it support, and it was then impossible to weed it out.

6. *New varieties of seed—Oats.*—Cape oats and three varieties of English oats, all from acclimatised seed, were sown on parallel plots marked out on a field which had been green-soiled with hemp, and were irrigated three times. The English varieties were so late in ripening that it was hopeless to expect much of a crop. The greater part of the crop was accordingly cut while still green and ensilaged.

The Cape oats, of which we were able to make so favourable a report last year, did still better this year, and the whole of the seed of this and of other plots has been distributed without our being able to satisfy all the indents received. The produce on the experimental plot measuring 1,386 square yards was equivalent to 2,026 lb of grain and 3303 lb of straw per acre.

Barley.—A field green-soiled with hemp was sown with parallel plots of country barley three English varieties (acclimatised seed) and Kotgarh naked or *rasuli* barley.

The area and outturn of the several plots is shown below :—

Variety.	Area in square yards.	Actual outturn.		Outturn per acre.	
		Grain.	Straw.	Grain.	Straw.
	lb.	lb. oz.	lb. oz.	lb.	lb.
Golden } English	377	97 4	209 0	1,248	2,683
Beardless } English	406	74 1	237 0	883	2,825
Peerless } English	394	90 9	227 0	1,112	2,788
Rasuli	286	66 4	145 8	1,121	2,462
Country	829	345 10	417 8	2,018	2,437

The country barley outdid its competitors, but it may be that the acclimatised English varieties, which did much better this year than last, may improve as time goes on.

As regards the *rasuli* barley, which has long been grown in Oudh as a curiosity, it so closely resembles wheat, that our farm sample passed inspection with skilled valuers in the Cawnpore market as true wheat. This supplies the strongest argument against promotion of its cultivation, as it might, if it could be grown so profitably as has been lately asserted, be used for adulteration to the detriment of the Indian wheat trade.

Wheat.—In a field green-soiled with hemp the ordinary farm seed (Muzaffarnagar white wheat) was tried against two English varieties (acclimatised). One of these latter was so hopelessly backward, that it was deemed best to consign it to the silo and the other was a case of much straw and little grain.

The following table gives results—

Variety.	Area in square yards.	*Actual outturn.*		*Outturn per acre.*	
		Grain.	Straw.	Grain.	Straw.
		lb. oz.	lb.	lb.	lb.
Rough chaff (English)	173	16 14	86	472	2,405
Farm wheat	328	110 0	148	1,623	2,183

Gram.—The three varieties tried last year, white, black, and red or ordinary country gram, were again tried this year, with the results tabulated below. The field had received no manure for two seasons but had lain fallow during the past kharíf. The plants were somewhat touched by frost, and though gram is not ordinarily irrigated, it was found advisable to give the fields two waterings :—

Variety.	Area in square yards.	*Actual outturn.*		*Outturn per acre.*	
		Grain.	Straw.	Grain.	Straw.
		lb. oz.	lb. oz.	lb.	lb.
White	233	31 12	33 8	659·5	695 8
Black	813	82 12	86 8	492·6	514·9
Red	618	123 0	138 0	963·3	1080·7

The grain in all three varieties was very fine, but the red variety would appear to be that best suited to the Duáb.

Linseed.—Two sets of experiments were carried out—(1) for fibre as a paper-making material, (2) to test the oil-yielding properties of two varieties.

Land was selected which had lain fallow during the kharíf and had been unmanured for two years. Contiguous plots were sown (for fibre) thickly with Riga (acclimatised) and country linseed respectively. The Riga seed germinated very unevenly, and although on an average the Riga crop stood 24 inches against 15 inches in the country variety, the stems of the former were less bulky and the yield in consequence much lighter.

As soon as the crops commenced to flower, strips were cut from each plot and the produce was sent to the Lucknow paper mills for trial. Similar strips were cut at later stages and despatched, and finally from the last strips the stems were sent after the ripe seed had been extracted.

Of course had the stems been steeped and scutched at the farm and the flax alone been sent, it would have been easy enough to make paper from it ; but the object in view was to test a statement that has been widely published, to the effect that the paper maker will take the stems without previous preparation, and forthwith reduce them to his purposes.

So far this has failed in proof, the insolubility of the lignose or "boon" proving a not unexpected difficulty.

(2) The varieties tested for oil were the ordinary blue-flowered and brown-seeded linseed of the Duáb and a variety of white linseed from Jalaun, the flower of which is also white. The area and outturn of the plots sown is shown below :—

Variety.	Area in square yards.	*Outturn of seed.*	
		Actual.	Per acre.
		lb. oz.	lb.
White	1,211	79 14	319
Red	1,858	129 0	336

Frost struck both plots when in flower, thus both lessening the yield considerably and rendering a comparison of yield as to seed impracticable.

Eight pounds were taken of each and were put into a native oil press with the usual proportion of water and with the following result :—

Number of trial.	Variety.	Weight of seed.	Weight of water added.	Weight of oil.	Weight of oil-cake.
		lb.	lb.	lb.	lb.
1	White	8	1½	2·75	4·5
2	Ditto	8	1½	2·87	4·19
3	Farm red	8	1½	2·5	5·19
4	Red purchased in bazaar ...	8	1½	2·37	5·37

It was not only in quantity that the oil from the white variety excelled, but in quality also, being much brighter and of finer colour. In the bazaar the "white" oil was valued as 15 per cent. better than the "red ;" a better test of course would be extraction with ether, but I have not yet had leisure for carrying it out.

7. *Nankin Cotton.*—As noted in the kharíf report, a further picking of 41·2 lb. was obtained in April and May, giving a total of 144 lb. clean cotton to the acre. The plants have been ratooned and seem very vigorous. A larger extent of ground has been prepared against next year.

8. In the rabi report for last year it was noted how white ants had spoilt some of the experiments by attacking the farmyard manure. White ants on unoccupied ground seem to perform a service for agriculture similar to that performed by the earthworm in England. At the same time they are often a pest, especially to sugarcane growers, and have put a stop to sugarcane growing in some parganas. I may mention therefore a remedy which Mr. Ridley of the Lucknow gardens has put to test. Kerosine oil will not of itself mix with water, but if first shaken up with milk it will amalgamate with that, and can be then diluted with water to any desired extent, a little of it going a long way and proving a very effective insecticide. Mr. Ridley found a mixture of two parts of oil to one of sour milk "churned" together to mix completely. Diluted to the extent of one wineglass to four gallons of water, it was in no wise injurious to plants or grass.

9. *Ensilage*—In the report on the kharíf harvest, I gave details of the attempt that had been made to gain some experience on the subject applicable to India. The farm silos were packed in September, following some rather ancient directions taken from the "American Agriculturist," which were all that I could, on taking charge, find available. On the 18th October a letter appeared in the *Times* newspaper from Professor Thorold Rogers on the advantages, of ensilage, and from that period may be said to date the great interest taken in the subject in England. The first hand-book published in England was one by Mr. Rogers in December last, which was followed in February and March by pamphlets issued by Mr. T. Christy, and by the *Field* office respectively. These pamphlets have added a good deal to what was previously known on the subject, but still leave points for settlement as regards India, which can only be set at rest by practical experiments. It may be again mentioned that the farm silos were damaged by very heavy rain in January, under circumstances which it was impossible to foresee or to guard against, save by an expenditure which would, with all previous experience of the force of our Duab winter rains, have been unwarrantable. After removing that portion which the rain had damaged, the remainder of the fodder in one of the silos was again covered over until the 2nd May. On reopening the pit, it was found that the fodder was not so good as when seen in January, having somewhat advanced in fermentation. Still it was readily and almost greedily eaten by the farm cattle. Noticeable differences were that the odour had changed from that of vinous fermentation to that of spenttan ; the fodder had darkened in colour, and in the place of being quite dry was, towards the bottom, reeking with sap liquor. The liquor was absorbed by a quantity of *bhusa* being thrown on it, and the cattle ate the latter just as readily as they had eaten the fodder. In March a quantity of green oats and corn was cut and ensilaged, but instead of being reduced by the chaff cutter to small pieces, an inch or so in length, the plan was tried (said to have been proved successful by some American experimentalists) of putting in the grass whole, and of heavily weighting the mass by baskets of stone and earth on a platform of planks and using no airtight covering. This silo was also opened in May, after lying for two months ; but although the cattle ate the fodder, it was not, in appearance and odour, suggestive of success. True, I have subsequently seen it asserted that no silo should be opened until three months have elapsed, but

I doubt whether fodder can be ensilaged whole with success unless very green and soft, and think that it should be cut small whenever practicable.

A small quantity of lucerne (6½ maunds) was chopped, made airtight with a covering of earth, and weighted as well, for two months. On uncovering it the odour of ammonia was quite overpowering, but soon passed off. In Mr. Christy's pamphlet is mentioned the fact that a sample of ensilaged clover from France was pronounced at an English Custom House to be fine American tobacco, which exactly describes the appearance of this lucerne. Only one animal could be induced to eat it, and he a Cabul donkey.

For the benefit of any who may purpose experimenting this season, and who may not have seen the pamphlets already alluded to, I may note a few points.

Salt is not now considered necessary.

Cut straw has been mixed with the fodder to absorb moisture, but whether this is an advantage or not is still undetermined.

In opening a large silo the air near the opening should be tested in the usual way, with a light, for carbonic acid.

Packing about two feet in depth daily is considered better than a rapid filling. The importance of compacting the fodder is strongly enforced.

One experimenter mentions "rubber blankets, tarpaulines, canvas or coarse cloth painted with boiled oil" as excellent for excluding air, while another uses a covering of six inches of straw before laying on weights on a plank platform.

Opinions as to the weight sufficient vary from 100 lb to 300 lb per square foot.

At the farm where *bhusa* is plentiful, it is proposed this year to sprinkle it plentifully as packing proceeds, and to cover the whole with bhusa a foot deep or so after weighing the fodder well until all air has been pressed out. Bhusa forms a good airtight covering and will at the same time all come in with the ensilage as fodder.

A chaffcutter appears to be a necessity, and hitherto such implements have been rather expensive; but a cheap form has recently been introduced in England, of which a trial will be made.

10. *Agricultural Implements.*—Further experience with the winnowers has determined me in removing the riddle frame and its belongings from the machine, and in concentrating the whole power on the blast. But without cogs I feel some doubt as to being able to multiply power in a way that shall rival in lasting effect that of an English winnower. When the wind fails in April and May it is singular how strong the desire for a winnower is; but with the rising gale the cultivator thinks ruefully of his money and votes the winnower an expensive toy.

The new plugs adopted for the pumps having in practice revealed defects, have been further modified and the following results have after continuous trials been obtained :—

Height of lift.	Description of lift.	Labour required.	Average quantity of water lifted per hour.	Useful work performed per minute in foot lbs.	Efficiency of the implement assuming the standard work of a man = 2,700* ft. lbs. and of a bullock = 12,000 ft. lbs.
Feet.			Cubic feet.		
5	Chain pump*	4 men	1,600	8,320	·77
„	Swing basket	4 men	464·7	2,416	·22
10	Chain pump	4 men	535	5,564	·51
15	Ditto	4 men	315	4,914	·45
„	Dhenkli	1 man	62	967	·36
20	Chain pump	4 men	272	5,657	·52
„	Single mote and inclined bullock-run	2 bullocks and 2 men ...	215·7	4,486	·15
25	Chain pump	4 men	197	5,122	·47
„	Single mote and inclined bullock-run	2 bullocks and 2 men ...	219·9	5,717	·19
30	Chain pump	4 men	125	3,900	·36
„	Single mote and inclined bullock-run	2 bullocks and 2 men ...	192·3	6,000	·20

* Taken from Rankine's treatise on steam engine. The labour on this lift was not so continuous as that on the other lifts owing to the rapidity with which the tank was filled. The figures given therefore are probably too high, and further trials will be made on a different system of measuring.

Ploughs.—A valid objection to the improved ploughs which have up to date been introduced in these provinces has been their inability to supersede the ordinary native plough for sowing purposes. Ordinary cultivators cannot afford at present prices to purchase an improved plough and maintain it in addition to the native one necessary for sowing purposes.

Following up a suggestion from the Commissioner of Agriculture for the Panjab, a new form of plough has lately been devised in the farm workshop which promises well.

Taking the form of plough most commonly used all over the provinces in which the sole is moveable, and is for use fixed in by a wedge a second sole is supplied which can be attached at will, and can be made up for two rupees. On this extra sole is a fixed iron breast, and by its use a clean furrough of five to six inches in depth is obtained, and the soil completely inverted. Several of the new pattern have been made up, and will be distributed for trial during the coming kharif season.

Hand threshing machine.—One was forwarded during the half-year from Messrs. Mayfarth and Company, Frankfort. In principle of action it resembles our large American thresher, and has like it the disadvantage in the eyes of the native of rejecting about 60 per cent. of the straw whole instead of reducing it to "bhusa."

The cost of the thresher in Germany was £ 6 and by the time it was set up at Cawnpore it had cost Rs. 128-9-0.

The following table gives the results of machine-threshing by hand and in the native fashion by treading out under cattle. In the case of the thresher the straw was reduced to bhusa by a hand-worked chaffcutter, the cost of which was originally Rs. 71.

Manner of threshing.	Labour required.	*Average amount threshed per day in maunds of 82lb.*		Cost of threshing per maund of wheat.	Cost of cutting by chaff per maund of grain.
		Grain.	Straw.		
				Rs. a. p.	Rs. a. p.
Hand thresher	5 Men ...	19·1	30	0 0 6·3	0 0 7 2
By bullocks	3 Bullocks ... 1 Man ... 1 Woman ...	2·25	3·75	0 2 9·3	

With an area, then, of (say) 15 acres yielding 240 maunds, the work of threshing and of reducing the straw to chaff would take 12·5 days at a cost of Rs. 16·89. To this must be added Rs. 24 as interest on the capital sunk in the two machines, giving a total of Rs. 40·89. Using cattle, the work would take 107 days at a cost of Rs. 41·5. It is true that some of the bullocks must always be kept for ploughing or for work at the well, but it may be questioned whether in the place of treading out corn the bullocks might not be more economically employed in raising water for the irrigation of a crop of green forage against the hot weather.

Another advantage in favor of the hand-thresher is the saving effected in the winnowing. The grain requires very little winnowing after leaving the machine, and is free from the earthy and manurial contaminations which are now laid to the charge of Indian wheat. The thresher is very strongly made and is well adapted to rough work. It was shown at the Khairabad and Bahraich agricultural shows, exciting everywhere most lively interest. The chaffcutter is always useful on the farm for cutting up winter fodder, and is likely to be more in demand if ensilage comes more into vogue. As already mentioned a new and cheaper form of chaffcutter has been ordered for trial.

Possibly with the development of the wheat trade, the advantage of getting clean wheat quickly into the market will dawn on the bucolic mind.

Sugar evaporator.—This machine, the credit of ordering which from America is due to Mr. Fuller, arrived too late for trial with either sorgho or sugarcane at the farm, nor as a matter of fact could I have seen to it properly at the time, being away on other duties.

At my request Mr. E. Macalister of Messrs. Carew and Co., Ld., very kindly undertook trials, the results of which are shown below:

Description of apparatus.	*Juice boiled in 12 hours.*		Amount of ráb made.	Labour required.	Fuel.	*Cost.*			Cost per maund of ráb made.
	Gallons.	Maunds and seers.				Labour.	Fuel.	Total.	
		M. s.	M. s. c.		M. c.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Evaporator	177½	23 11	4 1 0	2 men and 1 boy.	11 4	0 7 0	2 12 6	3 3 6	0 12 9
Karáhi (one flat shallow pan) ...	55	7 9	1 11 4	1 man and 1 boy.	5 19	0 4 0	1 6 0	1 10 0	1 4 4
Bel (5 pairs)	83	10 36	1 39 0	1 man and 1 boy.	7 32	0 4 0	1 15 3	2 3 3	1 1 10

Mr. Macalister adds the following notes :—

"The ráb produced from Cook's evaporator was all of best quality, light in colour, grainy, and with a minimum of molasses. The ease with which the natives worked, unassisted, and the uniform good quality of the outturn, are much in its favor."

From Rosa the machine was sent to the Gola Gokur Nath fair held in the Kheri district, on the 9th April and following days, in the heart of a good sugar-producing tract. Most of the country cane had been cut, and what was left was so acid and dry as to be no longer workable for sugar with the ordinary native apparatus.

In the evaporator, however, which was worked continuously through the fair as fast as six Bihia mills working simultaneously could supply it with juice, *ráb* of first quality was turned out to the manifest astonishment of the zamindars and cultivators, who constantly crowded round to watch, and who now and again roundly accused our men of using masalah. Pandit Ajudhia Pershad offered to take four for his own estate alone, if they could be produced at Rs. 100 each.

From Gola it was sent to the Fyzabad agricultural show on April 17th, which I was unable to attend. Major Barrow, Officiating Deputy Commissioner, writes as follows :—

"It worked very well indeed, and was highly approved. The ráb that was made was eagerly bought up at ten seers per rupee, whereas other ráb was selling at twelve and fourteen seers. The cleanness of the ráb attracted most attention; some critics said the ráb was "*phika*" or less sweet than ordinary ráb (possibly owing to the inferior cane left at so late a period of the season). I heard no other adverse criticism. The machine itself was much admired, and I could have sold four had they been available."

The evaporator is made of sheet metal, galvanized iron or copper, ours being of galvanized iron. At intervals of about 6 inches ledges run across the bottom of the pan (which is oblong and flat) and the alternate ends of the ledges being open, there is a continuous channel from one end of the pan to the other. These ledges are in the case of Cook's pan (the one imported) hollow and open at the bottom, which gives much more heating surface. The sides of the pan extend beyond the fire line of the furnace, so as to give a cooling surface for the collection of scum.

For portability it is constructed with a light iron furnace on rockers to admit of the pan being placed at any desired slope.

The cane juice is allowed to trickle in at the upper pan, and winding down round the ledges is clarified, defecated and evaporated in its course, arriving at the outlet in the state of consistency required. If skilfully managed the operation is almost continuous. The method of working it is very quickly learned, and where economy is an object, a clay furnace, which answers well, can soon be rigged out to take the place of the iron portable furnace.

The cost of this evaporator amounted to Rs. 330-15-0, a similar apparatus made up in this country should not cost more than Rs. 100, or of the pan alone Rs. 60 or so. Measures are now being taken for manufacture.

11. During the past year samples of farm produce and of improved implements were sent to the agricultural shows at Bijnor, Saháranpur, Aligarh, Bulandshahr, Meerut, Gola Gokurn, Khairabad, Fyzabad and Bahraich, and in each case medals, certificates, or prizes, were obtained in fair competition.

12. The correspondence of the year has been somewhat varied, extending to stations in every province of India as well as to some in native States.

13. Luchman Parshad Barmah has held the post of Superintendent and has zealously carried out the work with great intelligence and conscientiousness.

D. G. PITCHER, MAJOR,
Asst. Director for Oudh, in charge Exp. Farm, Cawnpore.

ORDERS OF GOVERNMENT.

No. 2209 OF 1883.

FROM

THE OFFG. SECRETARY TO GOVERNMENT,

N.-W. PROVINCES AND OUDH,

To

THE OFFG. DIR. OF AGRICULTURE AND COMMERCE,

N.-W. PROVINCES AND OUDH.

Dated Camp Lucknow, 19th October, 1883.

SIR,

UE DEPARTMENT. I AM directed to acknowledge the receipt of your letter No. 1274A., dated the 14th September, 1883, with which you submit your report on the operations of the Cawnpore Experimental Farm during the rabi season of 1882-83.

2. The management of the farm appears to have been satisfactory, and the results of the operations of the half-year are clearly set forth in the report. I am to suggest that special attention be given to the best methods of cultivating wheat, and the best varieties to be sown, as the development of the Indian wheat trade with Europe has become a matter of the greatest importance to the country.

I have the honor to be,

SIR,

Your most obedient servant,

J. R. REID,

Offg. Secretary to Government,
N.-W. Provinces and Oudh.